Appendix E

Draft Neutralization Options

DRAFT Neutralization Options for Lake Davis Pike Eradication Project

The Draft EIR/EIS will examine four different options for addressing the outflow from Grizzly Valley Dam into Big Grizzly Creek during the proposed rotenone treatment of Lake Davis, Plumas County as part of the Proposed Project. All of the options will require that neutralization personnel be housed on-site for daily living requirements. A portable house trailer and portable toilet will be installed at the staging area. The neutralization station will require between 10 and 15 persons during initial startup then scaled back to operational levels for the duration of the treatment. Only Option 1 will require fewer personnel due to the lack of chemical neutralization. The neutralization station will be operated 24 hours per day for the duration of the project (up to 45 days).

All options include a lowering of flow in Big Grizzly Creek. A fish rescue would occur prior to the rotenone treatment. CDFG, DWR, and local citizens would use nets to transport fish downstream of the area expected to be affected by dewatering of the streambed. The flow lowering would be ramped over several days to allow most fish to move downstream volitionally. As the flow reached a low, safe and wadeable level, as many fish as could be caught would be netted and transported to a fish transport truck that would take them to a site (to be determined) downstream.

If flow from the dam is shut off, accretion flows will add sufficient water to the channel to keep fish and macroinvertebrate populations in good condition through all but the uppermost reach of stream. In that uppermost reach, the gradual decrease in flows that would occur in combination with a fish rescue would minimize adverse impacts to fish. Some individuals may be lost within this reach, but the population would remain in good condition. DFG flow studies investigating stream flow while the outlet valve to Grizzly Valley Dam was shut off measured streamflow from accretion of 0.14 cfs at 408 yards downstream, 0.34 cfs at 1.6 miles, 0.36 cfs at 2.1 miles downstream, and 0.89 cfs at 3.3 miles downstream. Stream flows beyond this point are controlled by releases from the Grizzly Ice Pond.

Prior to the application of rotenone to Lake Davis, the Grizzly Valley Dam outlet valve would be completely shut off resulting in the flow of Big Grizzly Creek being reduced to approximately 4 gallons per minute (gpm) leakage at the base of the dam from toe drains and weep holes. No or insignificant leakage from the valve itself is expected. Approximately 400 yards downstream of the dam, accretion flow increases to 0.14 cfs. The leakage flow from the dam would be collected in a 30- to 60-gallon collection reservoir located immediately downstream of the base of the dam. This water would either be pumped directly back up into the reservoir (Scenario 1) or into a water tanker truck which would transport the ‘raw’ (non-neutralized) water back up to the reservoir and release it back into the reservoir area (Scenario 2).

The first scenario of includes the following parameters:

- Capture of the approximately 4 gpm leakage water in a 30 to 60 gallon collection reservoir located at the base of the dam. The pumping would continue until there is no detectable rotenone in the reservoir.

- It is estimated that a 1 hp electric (120V) submersible pump immersed in the 30 – 60 gallon collection tank would pump the water via a pvc conduit back up to the top of the dam and discharge the non-detoxified water back into the reservoir area. The pvc conduit would be routed via the spillway channel and temporarily secured with weighted sandbags.
- The pump system and plumbing would have a complete backup system should the primary system sustain a failure.
- Two 110 pound cans of potassium permanganate would be located on site in case of spill, leakage or other failure of the system.
- The neutralization station and water pumping would be continuously monitored to ensure that every component is functioning properly.
- The operation of the pump back would continue until fish are able to survive in Lake Davis.

The second scenario of includes the following parameters:

- Capture of the approximately 4 gpm leakage water in a 30 to 60 gallon collection reservoir located immediately downstream of the base of the dam. The pumping would continue until there is no detectable rotenone in the reservoir.
- It is estimated that a ½ hp electric (120V) submersible pump would pump the water via a pvc conduit up the staging area below the dam and discharge it into a water tanker truck. The estimated 4 gpm leakage would amount to 240 gallons per hour (gal/hr) or 5,760 gal/day. Assuming a 4,000 gallon capacity tanker truck would be used to haul and subsequently dump the water back into the reservoir area, two trucks would need to be stationed at the site. A manifold with a control valve would be used to ensure that at no time would the water not be pumped into a transport vessel. There would be two trips per day until there is no detectable rotenone in the reservoir.
- The truck loading area would be contained by a leak-proof containment area that would have two 110 lb. tins of potassium permanganate on site should a spill occur.
- The neutralization and water pumping station would be continuously monitored to ensure that every component is functioning properly.
- The operation of the pump/truck transfer would continue until fish are able to survive in Lake Davis.

The collection of the 4 gpm leakage would apply to all neutralization options. If in-stream neutralization is used, collection of the 4 gpm leakage would not continue once the in-stream neutralization commenced.

Option 1

Under Option 1, flow into Big Grizzly Creek would be shut off until the rotenone formulation in Lake Davis has degraded naturally (up to 45 days). No chemical neutralization of outflow would be required. There would be some flow in the creek due to accretion.

Option 2

Under Option 2, a neutralization station would be set up above the dam within the reservoir footprint in the vicinity of the spillway. Releases from Grizzly Valley Dam would be slowly reduced and then stopped for 5 days during and after the application of rotenone in Lake Davis.

Beginning on or about the sixth day, reservoir water would be pumped through screens to the neutralization station at a rate of 0.2 to 2.0 cfs. The neutralization station would neutralize rotenone with potassium permanganate ($KMnO_4$) using a system of pumps and containers. $KMnO_4$ would be applied at a rate of 2 to 4 mg/liter. Containers would be designed to allow for 30 to 60 minutes of contact time between the rotenone and potassium permanganate, allowing for thorough neutralization (see Table 1.0 for examples of vessel sizes needed for various flows of treated water). For flows up to about 0.5 cfs, a secondary filter system, such as granular activated charcoal (GAC), has been suggested. This could be used to remove residual rotenone formulation constituents, but would not be necessary for removing the rotenone itself. After being treated at the neutralization station, the water would be piped over the dam and down into Big Grizzly Creek, below the containment system.

Neutralization Option 2 would occur for about 14 to 45 days. The spring flow downstream of the dam would supplement the flow of the neutralized water in Big Grizzly Creek, below the dam.

Table 1.0. $KMnO_4$ Reaction Vessels sizes for varying instream flow releases

Release Rate	GPM	Gal/ 30 min	Vessel Size (gal)	Foot Print (ft^2)*
0.2	90	2700	3000	~100 ft^2
0.3	135	4050	5000	~120 ft^2
0.4	180	5400	7500	~120 ft^2
0.5	225	6750	10000	~150 ft^2

*Foot print needs to be doubled to accommodate two reaction vessels. (No matter the flow rate, there would need to be two reaction vessels) Footprint estimate does not include space required for GAC filtration system.

Containment berms would need to be large enough to accommodate access to plumbing and reaction vessels

Option 3

This option examines instream neutralization of a 1 to 2 cfs flow using granular potassium permanganate at 2 to 4 mg/L with the objective of maintaining a target concentration of $KMnO_4$ of 0.5 to 1.0 mg/L at the 30-minute flow travel station located approximately 1/3 mile downstream of Grizzly Valley Dam. The target value of 0.5 to 1.0 mg/L $KMnO_4$ provides the capability to neutralize any rotenone that may not have oxidized during the 30-minute travel time downstream of the dam. This option would shut off the release flows from Grizzly Valley Dam for up to 5 days after the application of rotenone begins in Lake Davis. The cessation of flows would allow the rotenone formulation in the reservoir to completely mix thereby reducing the chances for higher concentration plumes of rotenone to pass downstream through the neutralization station. Water sampling results from Lake Davis in 1997 indicated that the reservoir completely mixed within 24 to 48 hours after the application of rotenone. After 5 days, the instream flow releases to Big Grizzly Creek would be resumed

at 1 to 2 cfs. This option would require that 750 pounds of potassium permanganate be onsite to complete the neutralization.

The site of this neutralization station would be located at the staging area at the base of the dam. The potassium permanganate would be discharged directly to the stream flows at a concentration ranging from 2 to 5 mg/L to allow for complete neutralization of the rotenone. The potassium permanganate would be applied using an 115V electric volumetric feeder auger. The auger would be powered using either onsite electric power or 2000 watt, gasoline powered generators. A backup system using 2.5% solution $KMnO_4$ would be onsite should the granular application system fail. The 2.5% solution $KMnO_4$ would be dispensed from slurry reservoirs that would be located adjacent to the granular volumetric augers. The reservoirs would be contained within berms to ensure that leakage or vessel failures would be contained.

Sentinel fish would be located between the dam and the neutralization station, at the 15-minute flow travel mark, at the 30-minute mark, and at the 60-minute mark. The sentinel fish would be provided by a DFG hatchery and held nearby for continual restocking of the live cars throughout the duration of the neutralization operation. The live cars would contain 3 to 5 fish each. The live cars would be located in slack water areas to reduce stress levels. The fish located between the dam and the neutralization site would be replenished once per day to ensure that toxicity is still occurring in the release flows. Fish at the 15-minute and 30-minute marks would be checked every 2 to 4 hours and stressed, injured, or dead fish would be replaced as necessary. Fish at the 60-minute mark would be checked every 6 hours. All fish would be replaced daily.

Approximately 24 hours prior to shutting off the flow releases from the Grizzly Valley Dam the application of granular potassium permanganate would begin. This would allow the pre-oxidization of the neutralization zone downstream of the dam to the 30-minute mark (distance = ≈1/3 mile). Potassium permanganate would be discharged at 2 to 4 mg/L to ensure that the full range of delivery is tested. The 2.5% $KMnO_4$ slurry solution would also be tested after the granular tests are performed. The 2.5% solution would be released at 2 to 4 mg/L to ensure that the valves on the slurry reservoirs are properly calibrated. Concentrations of dissolved $KMnO_4$ would be measured and recorded at the 2-minute and 30-minute marks every ¼-hour using a colorimeter.

After completion of the pre-oxidization of the stream channel, the releases would be shut off for 5 days to allow the rotenone in the reservoir to thoroughly mix. The leakage of approximately 4 gpm from the toe drains and weep holes would need to be captured using techniques described in Option 1 above. The leakage water would be tested hourly for rotenone concentration and other constituents described in the Water Monitoring Plan.

After 5 days and determining that the reservoir has completely mixed, the streamflow outlet valves would then be opened to release the 1-2 cfs flow into Big Grizzly Creek. Neutralization would commence immediately using the volumetric auger. Discharge of the granular potassium permanganate would be measured bi-hourly using an electronic balance. Volumetric discharge of the granular potassium permanganate would be dependant upon the constant feedback of the $KMnO_4$ concentrations at the 2-minute and 30-minute marks.

- The neutralization of the rotenone laden water from the outlet would last from 14 to 45 day days depending on rate of the breakdown of the rotenone in the reservoir.
- Water samples at the 2-minute and 30-minute marks would be analyzed with a colorimeter to verify that $KMnO_4$ concentrations are at target levels.
- The 2-minute station target is the calculated concentration necessary to neutralize anticipated rotenone concentrations in Lake Davis.
- The 30-minute mark target concentration of 0.5 to 1.0 mg/L $KMnO_4$ verified by bi-hourly colorimeter samplings.
- A backup 2.5% solution $KMnO_4$ reservoir would be ready for use should volumetric auger system fail.
- Water samples will also be collected bi-hourly for laboratory analysis for parameters outlined in the water quality monitoring plan.
- The neutralization and water pumping station would be continuously monitored to ensure that every component is functioning properly.
- The operation of the instream neutralization would continue until fish are able to survive in Lake Davis.

Alternative 4

This option examines the instream neutralization similar to alternative 3, except that there would be a 3 to 5 cfs flow. This option would shut off the release flows from Grizzly Valley Dam for up to 5 days after the application of rotenone begins in Lake Davis. The cessation of flows would allow the rotenone formulation in the reservoir to completely mix thereby reducing the chances for higher concentration plumes of rotenone to pass downstream through the neutralization station. Water sampling results from Lake Davis in 1997 indicated that the reservoir completely mixed within 24 to 48 hours after the application of rotenone. After 5 days, the instream flow releases to Big Grizzly Creek would be resumed at 3 to 5 cfs. This option would require employing the same technology as Option 3 to dispense the granular potassium permanganate into the stream. A backup system using 2.5% solution $KMnO_4$ would also be required for this option. Due to the higher volume of flow discharging from the dam, the rates of granular or 2.5% solution $KMnO_4$ would be increased to ensure complete neutralization of the rotenone. The target concentration at the 30-minute mark would remain at 0.5 to 1.0 mg/L $KMnO_4$. The target concentration at the 2-minute mark would be the same as the calibrated discharge concentration of $KMnO_4$ from the auger or slurry reservoirs. This option would require that approximately 6,500 pounds of potassium permanganate be onsite to complete the neutralization.

Sentinel fish would be located between the dam and the neutralization station, at the 15-minute flow travel mark, at the 30-minute mark, and at the 60-minute mark. The sentinel fish would be provided by a DFG hatchery and held nearby for continual restocking of the live cars throughout the duration of the neutralization operation. The live cars would contain 3 to 5 fish each. The live cars would be located in slack water areas to reduce stress levels. The fish located between the dam and the neutralization site would be replenished once per

day to ensure that toxicity is still occurring in the release flows. Fish at the 15-minute and 30-minute marks would be checked every 2 to 4 hours and stressed, injured, or dead fish would be replaced as necessary. Fish at the 60-minute mark would be checked every 6 hours. All fish would be replaced daily.

Approximately 24 hours prior to the application of rotenone in Lake Davis, the application of granular potassium permanganate would begin. This would allow the pre-oxidization of the neutralization zone downstream of the dam to the 30-minute mark (distance = ≈1/3 mile). Potassium permanganate would be discharged at 2 to 5 mg/L to ensure that the full range of delivery is tested. The 2.5% $KMnO_4$ slurry solution would also be tested after the granular tests are performed. The 2.5% solution would be released at 2 to 5 mg/L to ensure that the valves on the slurry reservoirs are properly calibrated. Concentrations of dissolved $KMnO_4$ would be measured and recorded at the 2-minute and 30-minute marks every ¼-hour using a colorimeter.

Approximately 4 to 8 hours prior to the application of rotenone in Lake Davis, the application of granular potassium permanganate would begin. Discharge of the granular potassium permanganate would be measured using an electronic balance bi-hourly. Volumetric discharge of the granular potassium permanganate would be dependant upon the constant feedback of the $KMnO_4$ concentrations at the 2-minute and 30-minute marks.

- The neutralization of the rotenone laden water from the outlet would last from 14 to 45 days depending on rate of the breakdown of the rotenone in the reservoir.
- Water samples at the 2-minute and 30-minute marks would be analyzed with a colorimeter to verify that $KMnO_4$ concentrations are at target levels.
- The 2-minute station target is the calculated concentration necessary to neutralize anticipated rotenone concentrations in Lake Davis.
- The 30-minute mark target concentration of 0.5 to 1.0 mg/L $KMnO_4$ would be verified by bi-hourly colorimeter samplings.
- A backup 2.5% solution $KMnO_4$ reservoir would be ready for use should volumetric auger system fail.
- Water samples will also be collected bi-hourly for laboratory analysis for parameters outlined in the water quality monitoring plan.
- The neutralization and water pumping station would be continuously monitored to ensure that every component is functioning properly.
- The operation of the instream neutralization would continue until fish are able to survive in Lake Davis.